AIR POLLUTION
AND
AGRICULTURE

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AIR IS, LITERALLY, THE BREATH OF LIFE. WITHOUT IT, NOTHING CAN SURVIVE. THE POLLUTION OF AIR IS NOT A NEW PHENOMENON, AND UNDOUBTEDLY ORIGINATED WHEN MAN FIRST LIT A FIRE. IT WAS RECOGNIZED AS A PROBLEM DURING THE ROMAN TIMES AND BY THE 18TH CENTURY WAS PREVALENT IN MOST MAJOR CITIES OF EUROPE AND NORTH AMERICA.

AIR POLLUTION IS NORMALLY ASSOCIATED WITH SOME ACTIVITY OF MAN, BUT MAN IS NOT SOLELY RESPONSIBLE. THE HAZE NORMALLY SEEN IN THE COUNTRY-SIDE IS ASSOCIATED WITH PLANT LIFE WHILE WIND BORNE DUSTS, SALT SPRAYS AND POLLENS ARE ALSO NATURAL CONTAMINANTS OF THE ATMOSPHERE.

PRACTICALLY NO AIR IS ABSOLUTELY PURE, BUT WHEN THE CONCENTRATION OF CONTAMINANTS INTERFERES WITH THE WELL-BEING OF A PLANT, ANIMAL OR HUMAN LIFE, A POLLUTION PROBLEM MAY ARISE.

IT WOULD BE NEXT TO IMPOSSIBLE TO CATALOGUE THE RANGE OF CONTAM-INANTS RELEASED BY INDUSTRIES IN THE PROVINCE AND THEIR POTENTIAL EFFECTS. NOT ONLY MUST ONE CONSIDER THE CONTAMINANTS ALONE BUT ALSO THE NEW CHEMICALS WHICH MIGHT BE FORMED AS THE VARIOUS CONTAMINANTS REACT WITH EACH OTHER IN THE ATMOSPHERE. FOR EXAMPLE, THE SMOG PROBLEM THAT IS EXPERIENCED IN

PRACTICES OF ONLY 20 YEARS AGO. ON LARGER FARMS IT IS COMMON PRACTICE TO APPLY AGRICULTURAL DUST AND SPRAYS BY MEANS OF AIRCRAFT. IF THE AERSOL IS TOXIC AND DRIFTS AWAY BEFORE SETTLING OUT ON THE PLANTS, A HAZARD TO MEN, ANIMALS, AND OTHER CROPS MAY ENSUE. FORTUNATELY, DRIFT CAN BE MINIMIZED OR EVEN ELIMINATED BY LIMITING APPLICATION TO PERIODS OF LOW WINDS OR BY USE OF PARTICULATED SPRAYS.

WHILE IT IS GENERALLY AGREED THAT PESTICIDES ARE NECESSARY, IT MUST ALSO BE REALIZED THAT PESTICIDES CAN BE DANGEROUS TO THE ENVIRONMENT AND TO HUMAN HEALTH UNLESS THEY ARE USED PROPERLY.

IN SASKATCHEWAN, LAST YEAR, OVER 3 MILLION POUNDS OF 2-4 D and MCPA WERE USED TO TREAT OVER 9 MILLION ACRES. THE USE OF SUCH A TREMENDOUS QUANTITY OF PESTICIDES OVER SUCH A LARGE AREA MUST BE COMBINED WITH A CONCERN FOR THE ADVERSE EFFECTS THAT THIS CHEMICAL CAN HAVE IF IT IS NOT USED PROPERLY.

ACCORDING TO A SURVEY CARRIED OUT BY THE DEPARTMENT OF AGRICULTURE DURING THE SUMMER OF 1971 THERE ARE OVER 600 FEED LOTS IN THE PROVINCE HOUSING MORE THAN 100 ANIMALS. EACH OF THESE FEED LOTS AND MANY OF THE

CONTAMINANTS DISCHARGED ARE NOT DILUTED OR CARRIED AWAY AND START TO BUILD UP. FORTUNATELY THESE INVERSIONS ARE ONLY OF SHORT DURATION, 12 TO 14 HOURS, BUT THESE MAY BE SUFFICIENTLY LONG TO CAUSE, FOR EXAMPLE, DISCCLORED PAINT DUE TO HYDROGEN SULFIDE. THE PROBLEM OF AIR POLLUTION COULD BECOME MORE SERIOUS IF THE QUANTITIES OF AIR CONTAMINANTS RELEASED INTO THE ATMOSPHERE AT SUCH TIME SHOULD GREATLY INCREASE.

ONE OF THE MOST COMMON POLLUTANTS IS CARBON MONOXIDE. WHEN THIS POISONOUS GAS ENTERS THE BLOOD STREAM, IT REPLACES THE OXYGEN NEEDED TO CARRY ON THE BODY'S METABOLISM. AT HIGH CONCENTRATIONS IT CAN KILL QUICKLY; AND AT LOWER CONCENTRATIONS IT CAN BRING ON HEADACHES AND A SLOWING OF PHYSICAL AND MENTAL ACTIVITY.

ALTHOUGH THE BURNING OF ANY CARBON MATERIAL PRODUCES CARBON MONOXIDE TO SOME EXTENT, OUR PRIMARY CONCERN IS THE BURNING OF GASOLINE IN THE AUTOMOBILE, AND THE DISCHARGE LOW TO THE GROUND OF CARBON MONOXIDE FROM THE AUTOMOBILE EXHAUST. INSIDE AN AUTOMOBILE OPERATING IN TRAFFIC THE CONCENTRATIONS OF CARBON MONOXIDE MAY REACH HIGH ENOUGH LEVELS TO EFFECT THE DRIVER, THEREBY CREATING A SAFETY HAZARD. AT APPROXIMATELY 100 PARTS OF CARBON MONOXIDE FOR EVERY MILLION PARTS OF AIR MOST PEOPLE EXPERIENCE

1 1/2 TONS OF POLLUTANTS PER QUARTER SECTION OF STUBBLE. IN MANY AIR POLLUTION CONTROL JURISDICTIONS IT IS COMMON PRACTICE TO EXEMPT AGRICULTURAL OPERATIONS FROM AIR POLLUTION CONTROL REGULATIONS. IN FACT, OUR OWN PROVINCIAL REGULATIONS HAVE A CLAUSE WHICH ALLOW FOR THE BURNING OF STUBBLE FIELDS. HOWEVER, THE SEPARATION OF AGRICULTURAL FROM INDUSTRIAL OPERATIONS IS BECOMING MORE OBSCURE EVERY YEAR. AGRICULTURAL PRACTICES THAT CONTRIBUTE TO AIR POLLUTION SHOULD BE REVIEWED AND WHERE POSSIBLE CHANGES SHOULD BE MADE TO REDUCE THIS AIR POLLUTION POTENTION.

IT HAS BEEN ESTIMATED THAT THE AVERAGE COST OF AIR POLLUTION FOR A PERSON LIVING IN CANADA COULD RISE TO $115 PER YEAR BY 1980, OR A TOTAL COST OF APPROXIMATELY 3 BILLION DOLLARS.

AT THE PRESENT TIME SASKATCHEWAN HAS RELATIVELY FEW SERIOUS AIR POLLUTION PROBLEMS. HOWEVER, THE WARNING SIGNS ARE THERE AND POSITIVE ACTION MUST BE TAKEN NOW TO ELIMINATE ANY INCREASE IN THE AIR POLLUTION PROBLEM --

IN RECENT YEARS, A NUMBER OF DRAMATIC AIR POLLUTION EPISODES, UNDER VERY ADVERSE METEOROLOGICAL CONDITIONS, HAVE MADE US INCREASINGLY AWARE OF THE POSSIBLE DANGERS OF AIR POLLUTION. AS A RESULT WE NOW REALIZE THAT IT IS NO LONGER POSSIBLE TO ASSUME THE ATMOSPHERE HAS AN UNLIMITED CAPACITY TO HANDLE AND RENDER HARMLESS DISCHARGES UNDER ALL CIRCUMSTANCES. THESE INCIDENTS ALSO LED TO ADDITIONAL CONTROL LEGISLATION IN MANY COUNTRIES. THE SPECTRE OF THE POSSIBILITY OF GLOBAL POLLUTION EFFECTS HAS NOW ALSO BEEN INTRODUCED.

IN DECEMBER, 1930, A THICK AND STAGNANT FOG ENVELOPED A HEAVY INDUSTRIALIZED SECTION OF THE MUSE VALLEY IN BELGIUM. BY THE THIRD DAY MANY PERSONS DEVELOPED THROAT IRRITATIONS, HOARSENESS, COUGH AND BREATHLESSNESS. SOME WERE NAUSEATED. SOME DIED. THE ELDERLY AND THOSE ALREADY ILL WITH RESPIRATORY DISEASE OR HEART DISEASE WERE MOST VULNERABLE.

IN OCTOBER, 1948, A SIMILAR FOG BLANKETED THE SMALL INDUSTRIAL TOWN OF DENORA, PENNSYLVANIA. BEFORE AN AFTERNOON RAIN CLEARED THE FOG AWAY FOUR DAYS LATER, 6,000 PERSONS OF THE TOWN'S 14,000 CAME DOWN WITH ONE OR MORE OF AN ASSORTMENT OF ILLS - COUGH, SORE THROAT, CHEST CONSTRICTION, HEADACHE, A BURNING SENSATION OF THE EYES, NASAL DISCHARGE AND VOMITING. TWENTY PERSONS DIED DURING A PERIOD OF THE YEAR WHEN DENORA COULD EXPECT

ONLY TWO TO DIE. THOSE PRESENT REMARKED ON THE HEAVYNESS OF THE FOG, AND ON THE INTENSITY OF THE FAMILIAR ODOUR OF SULFUR DIOXIDE WHOSE SOURCE WAS LARGELY IN THE INDUSTRIAL OPERATIONS OF THE TOWN.

AT THE BEGINNING OF DECEMBER, 1952, THE CITY OF LONDON WENT THROUGH A FOUR DAY PERIOD OF STILL AIR DURING WHICH POLLUTION ACCUMULATED IN A PEA SOUP FOG. MONTHS LATER A REVIEW OF MORTALITY STATISTICS REVEALED THAT 4,000 EXCESS DEATHS HAD OCCURRED IN THE CITY DURING A SEVEN DAY PERIOD THAT BEGAN WITH THE FIRST DAY OF THE FOG. THE ILLNESS RATE DURING THE PERIOD, ESPECIALLY THE CARDIO-RESPIRATORY RATE, INCREASED TO NEARLY TWICE THE NORMAL RATE FOR THAT TIME OF YEAR AND DID NOT RETURN TO NORMAL 'TILL TWO TO THREE WEEKS LATER. LONDON WENT THROUGH A SIMILAR EPISODE IN 1962, AND THE CITY OF NEW YORK WENT THROUGH MUCH THE SAME KIND OF DISASTER IN 1953 AND AGAIN IN 1962.

THERE ARE OTHER EPISODES THAT HAVE BEEN RECORDED, AND SOME, NO DOUBT, THAT ARE UNRECORDED. ALL THE RECORDED EPISODES HAVE IN COMMON AN ABNORMAL ATMOSPHERIC CONDITION, THE SO-CALLED TEMPERATURE INVERSION DURING WHICH A BLANKET OF WARM AIR SEALS IN THE AIR SPACE UPON WHICH A COMMUNITY LIVES, AND PREVENTS DILUTION AND DISPERSAL OF ITS POLLUTANTS. TEMPERATURE INVERSIONS OCCUR FREQUENTLY IN MANY AREAS OF SASKATCHEWAN BUT DUE TO THE

LOW CONCENTRATION OF INDUSTRY THE LEVEL OF POLLUTANTS DOES NOT BUILD UP TO A DANGEROUS LEVEL.

THE AIR POLLUTION DISASTERS MENTIONED PREVIOUSLY ARE ALARMING ENOUGH, BUT OF EVEN GREATER CONCERN TO THOSE WHO LIVE IN POLLUTED AIR, ARE THE LONG TERM EFFECTS OF THE AIR POLLUTION ON THE GENERAL HEALTH. RESEARCHERS HAVE LONG EXPECTED THAT AIR POLLUTION IS THE CAUSE OF A LARGE NUMBER OF DISEASES. THESE ILLS ARE MOSTLY DISEASES OF THE BRONCHIAL TREE - FROM THE COMMON COLD TO LUNG CANCER. BUT AIR POLLUTION ALSO IRRITATES THE EYES, AND SOME POLLUTANTS IN THE AIR, LIKE LEAD, MAY BUILD UP IN THE BODY UNTIL THEY REACH HARMFUL LEVELS. OTHERS, LIKE CARBON MONOXIDE, ARE NOT ACCUMULATIVE IN THEIR EFFECTS, BUT IN HIGH ENOUGH CONCENTRATIONS CAN CAUSE TEMPORARY DISABILITY AND EVEN DEATH.

EMPHYSEMA IS A PROGRESSIVE BREAKDOWN OF AIR SACS IN THE LUNGS USUALLY BROUGHT ON BY CHRONIC INFECTION OR IRRITATION OF THE BRONCHIAL TUBES AND WHICH MAY PROGRESSIVELY DIMINISH THE ABILITY OF THE LUNGS TO TRANSFER OXYGEN TO THE BLOOD STREAM AND TO TAKE CARBON DIOXIDE FROM IT.

STUDIES HAVE DEMONSTRATED THAT EMPHYSEMA PATIENTS IMPROVE WHEN THEY ARE PROTECTED FROM AIR POLLUTION. IT HAS BEEN SHOWN IN THE UNITED STATES

THAT THE INCIDENCE OF EMPHYSEMA IS GREATER IN THE CITIES THAN IT IS IN THE RURAL AREAS AND THIS POINTS TO AIR POLLUTION AS A CONTRIBUTING FACTOR.

IN GREAT BRITAIN MORE ATTENTION HAS BEEN GIVEN TO THE PROBLEMS OF CHRONIC BRONCHITIS AND RESEARCH HAS SHOWN THAT CIGARETTE SMOKING AND AIR POLLUTION CAN BE GENERALLY ACCEPTED AS DISTINCT CAUSES OF CHRONIC BRONCHITIS. THE MORTALITY RATE FROM THE DISEASE IN GREAT BRITAIN HAS BEEN FOUND TO VARY DIRECTLY WITH SUCH AIR POLLUTION MEASURES AS POPULATION DENSITY, THE AMOUNT OF FUEL BURNED, SULFUR DIOXIDE LEVELS, SETTLED AND AIR BORNE DUST, DECREASED VISIBILITY. KNOWN SUFFERERS OF THE DISEASE WHO WERE SYSTEMATICALLY OBSERVED SHOWED A WORSENING OF THEIR SYMPTOMS ON DAYS OF HIGHER AIR POLLUTION.

BRONCHIAL ASTHMA IS A CONDITION OFTEN AGGRAVATED BY AIR POLLUTION. HOWEVER, SINCE THE LIST OF STIMULI CAPABLE OF TRIGGERING ASTHMATIC ATTACKS IS LONG IT IS DIFFICULT TO DEFINE THE ROLE OF AIR POLLUTANTS. SIMILARLY, IT MUST BE REALIZED THAT AIR POLLUTION IS NOT THE PRIMARY CAUSE OF DISEASES SUCH AS EMPHYSEMA OR CHRONIC BRONCHITIS BUT THAT IT CONTRIBUTES TO THE DEVELOPMENT OF THE DISEASE.

DEATHS FROM LUNG CANCER HAVE BEEN INCREASING RAPIDLY IN RECENT YEARS, AND WHILE MANY FACTORS ARE PROBABLY INVOLVED, THE STRIKING DIFFERENCE

BETWEEN THE URBAN AND RURAL MORTALITY RATE FOR LUNG CANCER POINTS TO ONE OF THE CAUSES - AIR POLLUTION. THE RATE IN LARGE METROPOLITAN AREAS IS TWICE THE RURAL RATE, EVEN AFTER FULL ALLOWANCE IS MADE FOR DIFFERENCES IN SMOKING HABITS. THE DEATH RATE FROM LUNG CANCER IS APPARENTLY DIRECTLY PROPORTIONAL TO CITY SIZE, AND THE SAME CAN BE SAID, IN GENERAL, FOR LEVELS OF AIR POLLUTION. IT WOULD BE VERY DIFFICULT TO DEFINE THE EXACT LEVELS OF AIR POLLUTION THAT COULD CAUSE THESE SORT OF DISEASES, BUT IT IS EXTREMELY DOUBTFUL IF THESE LEVELS ARE NOW BEING REACHED IN SASKATCHEWAN.

AIR POLLUTION CONTROL LEGISLATION IN SASKATCHEWAN WAS FIRST CONSIDERED IN 1964. THE ACT WAS SUBSEQUENTLY PASSED IN 1965 BUT PROCLAMATION WAS DELAYED UNTIL 1967 DUE TO LACK OF PERSONNEL.

THE ACT PLACES RESPONSIBILITY FOR AIR POLLUTION CONTROL AND PREVENTION ON THE DEPARTMENT OF PUBLIC HEALTH. THE ACT, AND SUBSEQUENT REGULATIONS, IS ADMINISTERED BY THE OCCUPATIONAL HEALTH BRANCH THROUGH ITS PROVINCIAL OFFICERS. POLLUTION CONTROL AND PREVENTION IS FACILITATED IN THAT REGIONAL OR CITY MEDICAL HEALTH OFFICERS AND PUBLIC HEALTH INSPECTORS HAVE AUTHORITY UNDER THE ACT TO ABATE AIR POLLUTION ARISING OUT OF INCINERATORS, FUEL-BURNING EQUIPMENT AND OPEN FIRES.

OVERALL GUIDANCE IN AIR POLLUTION AND CONTROL IS PROVIDED BY THE AIR POLLUTION ADVISORY COMMITTEE OF WHICH THE DIRECTOR OF THE OCCUPATIONAL HEALTH BRANCH IS CHAIRMAN. THE COMMITTEE IS AN EXPERT, RATHER THAN A REPRESENTATIVE COMMITTEE AND INCLUDES RECOGNIZED AUTHORITIES IN AIR POLLUTION, MINING AND INDUSTRIAL ENGINEERING, INDUSTRIAL MANAGEMENT AND ECONOMICS, METEOROLOGY, CROP SCIENCE AND PUBLIC HEALTH. IT MAKES ITS RECOMMENDATIONS TO THE MINISTER OF PUBLIC HEALTH.

THE COMMITTEE HAS APPROVED REGULATIONS UNDER THE ACT PERTAINING TO INDUSTRIAL AND COMBUSTION SOURCES. THE REGULATIONS ARE BASED ON THE MAINTENANCE OF A LEVEL OF QUALITY OF THE AMBIENT AIR RATHER THAN ON EMISSION STANDARDS.

THE PROVINCE'S DETERMINATION TO ACT IN THE BATTLE AGAINST AIR POLLUTION IS SHOWN IN THIS ACT AND REGULATIONS. HOWEVER, PRIOR TO THIS MANY MAJOR INDUSTRIES HAD ALREADY ANTICIPATED THE NEED AND DESIRE TO CONTROL AIR POLLUTION AND CONSEQUENTLY INSTALLED AIR CLEANING DEVICES IN THEIR PLANTS. THE POTASH INDUSTRY IS AN EXAMPLE AS IS THE PULP MILL AND MANY OIL REFINERIES.

THE PRIMARY PURPOSE OF THE REGULATIONS IS TO DEFINE ACCEPTABLE LIMITS OF VARIOUS AIR CONTAMINANTS IN THE COMMUNITY ATMOSPHERE. WHEN THESE LIMITS ARE EXCEEDED, THE OFFENDING PLANT OR PLANTS ARE IDENTIFIED AND ASKED TO ABATE THE POLLUTION. THERE ARE MANY PROS AND CONS TO THIS APPROACH BUT IT IS BELIEVED TO BE A STEP IN THE RIGHT DIRECTION. THE EMPHASIS IS ON A CO-OPERATIVE APPROACH.

ANOTHER PROVISION WITHIN THE REGULATIONS IS THAT ALL POTENTIAL AIR POLLUTION SOURCES WHETHER THEY BE COMBUSTION SOURCES (INCINERATORS OR POWER STATIONS) OR INDUSTRIAL SOURCES, MUST SUBMIT PLANS PRIOR TO CONSTRUCTION FOR REVIEW BY OUR AIR POLLUTION ENGINEERS.

THE SIGNIFICANT AND SOMETIMES DEVASTATING EFFECTS OF AIR POLLUTANTS ON CROPS AND VEGETATION HAVE LONG BEEN A MAJOR PROBLEM IN MANY PARTS OF THE WORLD. WHILE CROP DAMAGE DUE TO AIR POLLUTION RARELY OCCURS IN SASKATCHEWAN, I THINK IT IS IMPORTANT TO NOTE SOME OF THE PROBLEMS WHICH CAN BE CAUSED.

DAMAGE TO CROPS AND VEGETATION BY SULFUR DIOXIDE HAS BEEN RECOGNIZED AND RECORDED FOR OVER 100 YEARS. BUT EVEN WITH THIS WEALTH OF EXPERIENCE TO LEARN FROM, MANY AREAS ARE TODAY STILL PLAGUED WITH PROBLEMS OF SULFUR DIOXIDE POLLUTION. VEGETATION IN THE SUDBURY AREA IS STILL BEING DAMAGED BY SULFUR DIOXIDE EMISSIONS. ESTIMATES OF LOST REVENUE DUE TO REDUCED FOREST YIELD . CAUSED BY SULFUR DIOXIDE RANGE AS HIGH AS 2 MILLION DOLLARS OVER THE LAST 10 YEARS. ONE OF THE EARLIEST SULFUR DIOXIDE PROBLEMS OCCURRED IN TRAIL, BRITISH COLUMBIA. THE DAMAGE CAUSED BY THE SMELTER EXTENDED AS FAR AS, AND BEYOND, THE CANADA - U.S. BORDER.

SEVERAL YEARS AGO, POLLUTION PROBLEMS ASSOCIATED WITH THE DISCHARGE OF FLUORIDES FROM A FERTILIZER PLANT PRODUCING PHOSPHATE FERTILIZERS WAS EXPERIENCED IN SOUTH-WESTERN ONTARIO. INVESTIGATIONS REVEALED THAT CONSIDERABLE CROP DAMAGE WAS CAUSED AND THAT THE DISCHARGE OF FLUORIDES ONTO FORAGE AND THE RESULTANT CONSUMPTION RESULTED IN A MINOR PROBLEM OF FLUOROSIS IN SOME OF THE

LIVESTOCK IN THE AREA.

INJURY TO VEGETATION BY AIR POLLUTANTS RESULTS NOT ONLY FROM INDUSTRIAL SOURCES, BUT ALSO FROM SOURCES ASSOCIATED WITH THE COMPLEXITIES OF URBAN LIVING. THIS HAS BEEN WELL ILLUSTRATED DURING RECENT YEARS BY THE PHOTOCHEMICAL SMOG PROBLEM OF SOUTHERN CALIFORNIA. THERE ARE MANY RURAL AREAS IN SOUTHERN CALIFORNIA WHERE SENSITIVE CROPS CAN NO LONGER BE GROWN, AS THE SMOG PROBLEM CAUSED BY THE URBAN AREAS EASILY DESTROYS THE CROP.

A PLANT IS A PRODUCT OF ITS ENVIRONMENT, RESPONDING IN MANY WAYS TO THE STRESSES OF AND THE SUPPORT OF THAT ENVIRONMENT. AIR POLLUTION MUST BE CONSIDERED SIMPLY ANOTHER VECTOR OF THE ENVIRONMENT ALONG WITH CLIMATE, SOIL, INSECTS, DISEASES AND GENETIC HISTORY, AS WELL AS CARE OR ABUSE BY MAN. THE PATTERNS OF INJURY CREATED BY AN AIR POLLUTANT MAY NOT ONLY BE MODIFIED OR OBSCURED BY OTHER ENVIRONMENTAL FACTORS, BUT FROM THESE OTHER FACTORS THE PLANT MAY DEVELOP PATTERNS OF INJURY WHICH ARE DIFFICULT OR IMPOSSIBLE TO DISTINGUISH FROM AIR POLLUTION EFFECTS.

THE MODIFYING EFFECT OF CLIMATE, RAINFALL, TEMPERATURE AND WIND, ARE OFTEN DIFFICULT TO ASSESS. IN CROPS SUCH AS ALFALFA, A WATER STRESS PHENOMENA PRODUCES THE DISEASE OF OF WHITE SPOT WHICH IS OFTEN DISTINGUISHABLE FROM SULFUR

DIOXIDE DAMAGE ONLY WITH VERY GREAT DIFFICULTY. HIGH TEMPERATURES CAN PRODUCE A SCORTCH ON MANY TREES WHICH WILL APPEAR QUITE SIMILAR TO SULFUR DIOXIDE INJURY. TEMPERATURE AND WIND, UNDER CERTAIN CONDITIONS OF SOIL MOISTURE, CAN CAUSE AN EDGE BURN ON THE LEAVES OF MANY PLANTS WHICH IS VERY SIMILAR TO FLUORIDE INJURY.

CLOSELY RELATED TO THE FACTORS OF CLIMATE ARE THE ENVIRONMENTAL FACTORS OF SOIL, NUTRITION AND MANAGEMENT. ALL OF THE DAMAGED PATTERNS AND POOR GROWTH EFFECTS OF AIR POLLUTION CAN BE DUPLICATED BY THE PROPER COMBINATION OF POOR SOIL, NUTRITION, OR MANAGEMENT. IN ADDITION, THERE IS AN EXTREMELY LARGE NUMBER OF BACTERIA, FUNGI, VIRUSES, AND INSECTS, THAT CAN PRODUCE INJURY SYMPTOMS IN PLANTS WHICH ARE VERY SIMILAR TO THE SYMPTOMS PRODUCED BY AIR POLLUTANTS.

TO PROPERLY DIAGNOSE AIR POLLUTION EFFECTS ON VEGETATION, THE PROBLEM MUST, THEREFORE, BE SEEN IN THE FIELD, AND SHOULD PREFERABLY BE SUPPORTED BY MEASUREMENTS OF THE CONCENTRATION IN THE AMBIENT AIR OF THE SUSPECTED POLLUTANT; FURTHERMORE, THE OBSERVER MUST HAVE A THOROUGH KNOWLEDGE OF LOCAL CULTURAL CONDITIONS.

AS POTASH MINING IS ONE OF THE LARGEST INDUSTRIES IN THE PROVINCE, ONE OF THE FIRST AIR POLLUTION MONITORING PROGRAMS SET UP BY THE BRANCH WAS A SERIES OF STATIONS AROUND THE ALLAN POTASH MINE, TO MEASURE POTASH FALLOUT. THE PROGRAM WAS SET UP IN 1968 AND WITH THE EXCEPTION OF THE WINTER OF 1970-71, HAS BEEN IN OPERATION UP TO THE PRESENT. A SIMILAR PROGRAM WAS SET UP AROUND THE TWO I.M.C. MINES AT ESTERHAZY IN LATE 1969 AND CONTINUED THROUGH TO AUGUST 1970. THE FOLLOWING SLIDES SHOW SOME OF THE RESULTS AND WHILE I DO NOT WANT TO GET INVOLVED IN THE DETAILS OF THE RESULTS, I WOULD LIKE TO GIVE YOU AN INDICIATION OF THE FALLOUT ~~FOLLOWED~~ PATTERNS AROUND THE MINES.

THE AIR MANAGEMENT DIVISION HAS ONLY INVESTIGATED ONE EPISODE OF SUSPECTED VEGETATION DAMAGE, WHICH OCCURRED AROUND THE ALWINSAL MINE DURING THE SUMMER OF 1970.

OUR INITIAL INVESTIGATION INDICATED THE LIKELIHOOD THAT VEGETATION DAMAGE WAS OCCURRING. TO FURTHER DEFINE THE PROBLEM, A COMPLETE SURVEY OF THE SURROUNDING AREA WAS CARRIED OUT BY A RESEARCH OFFICER WITH OUR BRANCH TO DETERMINE THE EXTENT OF VEGETATION DAMAGE AND THE BRANCH INITIATED A SURVEY OF CORROSION EFFECTS AROUND THE MINE SITE.

DAMAGE TO THE TREES CONSISTED OF DEFOLIATION AND CLUMPING OF LEAVES. THERE WAS NO INDICATION OF DAMAGE TO ANY CROPS IN THE AREA.

THE VEGETATION SURVEY CONCLUDED THAT IN SPITE OF THE LIMITATIONS OF HAVING NO PREVIOUS KNOWLEDGE OF THE CONDITION OF VEGETATION IN THE AREA AND CONDUCTING THE SURVEY LATE IN THE GROWING SEASON, A DEFINITE EFFECT CAN BE SEEN ON VEGETATION AROUND THE MINE. THE REPORT FURTHER STATED "THAT THERE IS GOOD EVIDENCE TO SUPPORT THE THEORY THAT POLLUTION OF SOME SORT FROM THE PLANT HAS HAD AN EFFECT ON SURROUNDING VEGETATION. THE STRENGTH OF THE ARGUMENT LIES NOT IN THE TYPE OF DAMAGE ITSELF, AS MUCH AS THE SPACIAL RELATIONSHIP OF THE EVIDENCE." THAT IS, THE CONCLUSION IS NOT BASED SO MUCH ON A POSITIVE IDENTIFICATION OF THE DAMAGE, BUT ON THE LOCATION OF THE DAMAGED TREES IN RELATION TO THE MINE SITE.

THE CORROSION SURVEY STATED THAT "GALVANIZED METAL STRUCTURES, PARTICULARLY GUY WIRES AND CATTLE GUARDS ON POWER LINES WERE THE BEST INDICATORS OF THE CORROSIVENESS OF THE FALLOUT FROM THE MINES. THE PATTERN OF THE CORROSION ON THE CATTLE GUARDS WAS VERY DISTINCTIVE AND APPEARED TO BE CONFINED TO POTASH MINE AREAS. NO DUPLICATION OF THIS PATTERN COULD BE FOUND ANYWHERE

IN THE PROVINCE."

AT THE TIME THESE SURVEYS WERE CARRIED OUT, THE MINE HAD NOT OVERCOME THE TECHNICAL PROBLEMS OF THEIR CONTROL SYSTEM. HOWEVER, A CONTROL SYSTEM WAS PUT INTO OPERATION IN THE FALL OF 1970 AND TEST RESULTS INDICATE THAT IT IS OPERATING SATISFACTORILY. FURTHER PROBLEMS OF THIS NATURE IN THE AREA ARE NOT ANTICIPATED.

AIR POLLUTION EFFECTS OF A DIFFERENT NATURE HAVE BEEN ENCOUNTERED IN THE OIL AND GAS FIELDS IN SASKATCHEWAN, PARTICULARLY IN THE WEYBURN-ESTEVAN AND THE LLOYDMINSTER AREA. DISCHARGE OF THE HIGHLY ODOUROUS GAS, HYDROGEN SULFIDE, FROM FIELD BATTERIES AND OIL WELL SITES, HAS RESULTED IN NUMEROUS COMPLAINTS RELATED TO THE ODOUR PROBLEM.

WHILE ONE INCIDENT POSSIBLY INVOLVES SOME ORNAMENTAL TREE DAMAGE, THE MAJORITY OF COMPLAINTS INVOLVE PROBLEMS OF ODOUR AND PAINT DISCOLOURATION OF HOMES AND FARM BUILDINGS. ALMOST ALL OF THE COMPLAINTS HAD COME FROM FARMERS WHO ARE DIRECTLY EFFECTED BY THE RELEASE OF THESE GASES. SO WHILE NO CROP OR VEGETATION DAMAGE IS INVOLVED, POLLUTION OF THIS TYPE HAS A DEFINITE EFFECT ON AGRICULTURE BY AFFECTING THE FARMERS ENJOYMENT OF LIFE AND BY CAUSING

PROPERTY DAMAGE.

NUMEROUS CONTROLS ARE AVAILABLE AND WE HAVE HAD VERY GOOD SUCCESS IN ELIMINATING THE SOURCE OF THE COMPLAINT.

WHENEVER NATURAL SOIL IS DISTURBED A LATENT DUST PROBLEM IS CREATED. THE PROBLEM BECOMES PARTICULARLY BOTHERSOME IN LOW RAINFALL AREAS DURING PERIODS OF HIGH WINDS. EVEN IN AREAS OF LOWER WIND SPEEDS, SOIL TILLING ON MARGINAL LAND RELEASES GREAT QUANTITIES OF DUST DURING SOIL PREPARATION AND PLANTING. THE CONVERSION OF RANGE LAND IN WESTERN KANSAS AND OKLAHOMA TO WHEAT LAND IN THE 1920'S LED TO THE DEVESTATING DUST STORMS OF THE EARLY 1930'S. THE DUST WAS CARRIED BY THE WIND AS FAR AS THE EASTERN SEABOARD OF THE UNITED STATES. DUST RAISED BY HIGH WINDS IN SOME AGRICULTURAL AREAS CAN LEAVE A FINE POWDER IN THE AIR FOR DAYS AFTER. MANY AREAS IN THE UNITED STATES HAVE PASSED REGULATIONS RESTRICTING THE TIME WHEN PLOWING AND CULTIVATION MAY BE DONE, OR THE TYPE OF CULTIVATION EQUIPMENT THAT MAY BE USED. THE PROBLEM OF DUST DUE TO AGRICULTURAL OPERATIONS IN SASKATCHEWAN IS NO WAY NEAR AS SEVERE AS IN MANY AREAS OF THE STATES, HOWEVER, OUR DUST FALL MEASUREMENTS IN THE CITIES HAS BEEN ABLE TO DETECT AN INCREASE IN DUST CONCENTRATION DURING THAT PERIOD OF THE YEAR WHEN SOIL PREPARATION IS TAKING PLACE.

AGRICULTURE HAS ALWAYS BEEN DEPENDENT TO A GOOD EXTENT ON PEST CONTROL, AND THE PRESENT EXTENSIVE USE OF PESTICIDES FAR EXCEEDS THE

LOS ANGELES IS NOT CAUSED BY THE RELEASE OF CONTAMINANTS DIRECTLY INTO THE ATMOSPHERE BUT IT IS CAUSED BY THE SECONDARY REACTION PRODUCTS, THE PRODUCTS THAT ARE PRODUCED IN THE AIR UNDER THE ACTION OF SUNLIGHT AND HUMIDITY. THESE NEW CHEMICALS MAY ADVERSELY EFFECT HUMAN, ANIMAL OR PLANT HEALTH TO A MUCH GREATER EXTENT THAN THE INITIAL CONTAMINANTS.

AIR POLLUTION CONTROL IS THUS CONCERNED WITH LIMITING THE AMOUNTS OF MAN-MADE CONTAMINANTS DISCHARGED INTO THE AIR SO THAT THE PEOPLE LIVING WITHIN THE COMMUNITY ARE NOT DEPRIVED OF ENJOYING THE ANEMITIES OF LIFE OR HEALTH, THAT PLANT AND ANIMAL LIFE IS NOT INJURED AND THAT PROPERTY IS NOT ADVERSELY AFFECTED.

NORMALLY, THE ATMOSPHERE CAN ABSORB MANY POLLUTANTS. THEY ARE DILUTED IN THE AIR AND REMOVED AS PART OF THE NATURAL CLEANING PROCESS. IF THIS HAPPENS AS FAST AS POLLUTANTS ARE RELEASED, THEN THE CONSEQUENCES ARE NEGLIGIBLE. HOWEVER, SOMETIMES UNUSUAL WEATHER CONDITIONS INTERFERE WITH THE NORMAL PROCESS AND A TEMPORARY POLLUTION PROBLEM ARISES DUE TO STAGNANT AIR OR LIMITED VENTILATION.

WINTER MONTHS, IN GENERAL, PRODUCE A GREAT NUMBER OF INVERSION LAYERS, PARTICULARLY OVER OUR MAJOR CITIES. UNDER THESE CONDITIONS

SMALLER ONES REPRESENT A TREMENDOUS POTENTIAL FOR AIR POLLUTION PROBLEMS DUE TO ODOUR. CONTROL OF THE ODOUR PROBLEM DEPENDS PRIMARILY ON SANITATION AND HOUSE-KEEPING. A LARGE NUMBER OF COMPLAINTS ARE RECEIVED EVERY YEAR CONCERNING FEED LOTS THAT ARE IMPROPERLY MANAGED WITH THE RESULTANT ODOUR AND FLY BREEDING PROBLEMS.

ONE OF THE MOST SIGNIFICANT CONTRIBUTIONS OF AGRICULTURE TO AIR POLLUTION RESULTS FROM THE PRACTICE OF BURNING STUBBLE FIELDS. I WAS EXTREMELY SURPRIZED WHEN I STARTED TO CALCULATE FIGURES FOR POLLUTANTS RELEASED BY THE BURNING OF STUBBLE AND I REACHED A FIGURE OF 600 MILLION POUNDS OF CARBON MONOXIDE PRODUCED EVERY YEAR BY THE BURNING OF STUBBLE FIELDS IN SASKATCHEWAN. THIS FIGURE IS ROUGHLY EQUIVALENT TO THE AMOUNT OF CARBON MONOXIDE PRODUCED BY ALL THE AUTOMOBILES IN THE PROVINCE EVERY YEAR. A TOTAL FIGURE FOR ALL OF THE AIR POLLUTANTS PRODUCED BY BURNING STUBBLE EVERY YEAR WORKED OUT TO APPROXIMATELY 1 BILLION POUNDS PER YEAR OF POLLUTANTS OR 500 THOUSAND TONS. WHILE IT CAN BE ARGUED THAT THIS AMOUNT HAS LITTLE EFFECT BECAUSE IT IS SPREAD OUT OVER THE ENTIRE PROVINCE, IT MUST ALSO BE REALIZED THAT MOST OF THE STUBBLE BURNING TAKES PLACE OVER A SHORT PERIOD OF THE YEAR. THESE FIGURES REPRESENT ABOUT

DIZZINESS, HEADACHE, LASSITUDE, AND OTHER SYMPTOMS OF POISONING. FOR EXAMPLE, CONCENTRATIONS OF MORE THAN 100 PARTS PER MILLION WERE FOUND OCCASIONALLY DURING SEVERAL MONTHS OF OBSERVATIONS IN HEAVY TRAFFIC IN DETROIT AND IN LONDON. RECENT MEASUREMENTS FREQUENTLY EXCEEDED THIS FIGURE. TESTS HAVE SHOWN THAT CARBON MONOXIDE MAY PREVENT US FROM RESPONDING PROPERLY IN A COMPLEX SITUATION, SUCH AS DRIVING IN TRAFFIC. THE EFFECTS MAY BE SIMILAR TO THE EFFECTS OF ALCOHOL OR FATIGUE. IN FACT, CARBON MONOXIDE MAY BE DOUBLY DANGEROUS WHEN A DRIVER IS TIRED, HAS HAD AN ALCOHOLIC BEVERAGE OR IS UNDER TREATMENT WITH CERTAIN DRUGS SUCH AS TRANQUILIZERS.

THE COAL AND OIL THAT ARE BURNED SO ABUNDANTLY ALL OVER THE WORLD TO HEAT BUILDINGS AND TO GENERATE POWER CONTAIN ELEMENTAL SULFUR AS AN IMPURITY. WHEN THE FUEL IS BURNED THE SULFUR BURNS TOO, PRODUCING SULFUR DIOXIDE GAS AND TO MUCH SMALLER EXTENT, SULFUR TRIOXIDE, WHICH IN THE ATMOSPHERE IMMEDIATELY CONVERTS TO SULFURIC ACID. SULFUR DIOXIDE GAS ALONE CAN IRRITATE THE UPPER RESPIRATORY TRACT; ABSORBED IN PARTICULATE MATTER IT CAN BE CARRIED DEEP INTO THE LUNG WHERE IT CAN INJURE DELICATE TISSUE. SULFURIC ACID IN THE RIGHT PARTICULE SIZE CAN ALSO PENETRATE DEEP INTO THE LUNG AND DAMAGE TISSUE.